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Vulnerability of US Oil Supplies in the Caribbean

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A Research Paper

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Vulnerability of US Oil Supplies in the Caribbean

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A Research Paper

This paper was prepared by [redacted] Office of
Global Issues, [redacted] Office of African
and Latin American Analysis, with a contribution
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welcome and may be directed to the Chief, Petroleum
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**Vulnerability of
US Oil Supplies
in the Caribbean**

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Summary

*Information available
as of 19 October 1984
was used in this report.*

The Caribbean region is vital to US energy security. Last year about 5 million barrels per day (b/d) of US petroleum consumption—about one-third of the total—originated in or transited the region. We estimate that, including shipments to other countries in the region, approximately 8 million b/d of oil, or one-third of the world's oil trade, came from or through the Caribbean region in 1983.

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Two key passages, the Yucatan Channel and the Straits of Florida, handle almost half the oil transiting the region and either passage is potentially vulnerable to military interdiction from Cuba. Facilities that produce and export the over 3 million b/d of oil from the area—mainly in Mexico and Venezuela—are also highly vulnerable to attack or sabotage. Mexico is particularly susceptible because of minimum redundancy in the petroleum handling facilities in its major offshore oilfields. In our view, even with several thousand US military personnel, the Panama Canal and oil pipeline through Panama—carrying about 1.4 million b/d of oil—are also highly vulnerable.

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Despite the vulnerability of the facilities, we do not expect a serious curtailment in the near future:

- The availability of alternative transportation routes through the Caribbean reduces the significance of many of the area's choke points.
- Current apparent political and social stability in Mexico and Venezuela, the region's major oil producers, decreases the potential of major supply disruptions being caused by internal problems.
- Approximately 7 million b/d of excess oil productive capacity is outside the Caribbean region and should be available through most of the decade.
- Lower US oil consumption and imports, and the availability of excess refinery capacity in the United States, greatly lessens US dependence on the Caribbean's export refineries and transshipment terminals.

Over the longer term, if worsening economic conditions in Mexico or Venezuela led to internal unrest or a reappraisal of relations with the United States, oil shipments could perhaps be curtailed. Although the United States probably would be able to obtain oil from other sources, there probably would be at least temporary supply disruptions until world oil supplies stabilized. Beyond this, individual oil facilities or transportation systems could become an attractive target for terrorist or insurgent groups. The impact in these circumstances would be principally on the country involved rather than on US supplies.

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Vulnerability of US Oil Supplies in the Caribbean

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Introduction

About 70 percent of US petroleum imports—30 percent of domestic consumption—originates in or transits the Caribbean region.¹ US imports transiting the Caribbean Sea or entering the Gulf of Mexico must pass through such potential choke points as the Straits of Florida and Yucatan Channel, and large quantities of Alaskan crude are shipped to refineries in the Caribbean or eastern United States through the Canal and oil pipeline in Panama. Oil facilities in key exporting countries in the area, such as Mexico and Venezuela, are highly vulnerable to attack. Any hostility against oil supplies in the Caribbean could hurt the United States.

This research paper addresses the importance to the United States of the free flow of oil through the Caribbean region. It discusses the producers, major facilities, and land and sea routes in the Caribbean Basin and Gulf of Mexico that supply oil to the United States; assesses their vulnerability to both internal and external threats; and examines the United States' ability to compensate for these disruptions.

Major Oil Suppliers

The United States receives about 40 percent of its crude oil and petroleum product imports from the Caribbean region, primarily from Mexico and Venezuela. In turn, revenues generated by oil exports to the United States are vital to the economies of these countries. Unlike a number of countries in the Caribbean region, Mexico and Venezuela have experienced relative political stability for some time and in recent years generally have been free from such internal threats as insurgency or terrorism. Both countries

¹ For this paper, the Caribbean region includes the Caribbean Sea, Gulf of Mexico, their associated littorals and sea approaches, and The Bahamas.

maintain cordial relations with the United States—although Mexico traditionally has been more suspicious of US motives—and share extensive economic ties to the United States in nonoil areas as well.

We doubt that these countries would intentionally jeopardize their important oil relationship with the United States. Nonetheless, the severity of the foreign payments and domestic economic problems that they are experiencing will introduce unaccustomed internal stresses over the next few years. If the internal political setting changed as a result, or if US policy led to flagging financial support or rising protectionism, these countries might pursue more vigorously alternate markets for oil customarily sold to the United States. Although the possibility is remote, Mexico City and Caracas also could cut oil shipments in response to a US military intervention in Central America, if it appeared to them that the action was unjustified.

The likelihood and domestic economic impact of such moves would depend primarily on conditions in the world oil market, the availability of other customers, and the level of support among other oil producers. Because these countries must export oil to earn the hard currency needed to support economic development programs, however, it could be difficult for them to develop other markets for the large volumes of oil customarily sold to the United States. If Mexico and Venezuela exported oil elsewhere, leaving the total world supply largely unaffected, the United States could continue to buy oil from other sources, although initially there would be some disruptions.

Mexico: Trying To Diversify Its Oil Customers

Last year Mexico was the United States' main foreign source of oil, with over 800,000 b/d of Mexican crude and product imported—16 percent of the US total. At the same time, the United States was the largest

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Table 1
United States:
Oil Imports, 1979 and 1983 ^a

Origin	1979		1983	
	Volume (1,000 barrels per day)	Percent	Volume (1,000 barrels per day)	Percent
Total imports ^b	8,456	100.0	5,051	100.0
Total OPEC	5,637	66.7	1,860	36.8
Saudi Arabia	1,356	16.0	337	6.7
UAE	281	3.3	30	0.6
Iran	304	3.6	48	1.0
Algeria	636	7.5	240	4.8
Libya	658	7.8	0	0
Nigeria	1,080	12.8	302	6.0
Indonesia	420	5.0	338	6.7
Venezuela	690	8.2	422	8.4
Other OPEC	212	2.5	143	2.8
Total Non-OPEC	2,819	33.3	3,189	63.1
Mexico	439	5.2	826	16.4
Canada	538	6.4	547	10.8
United Kingdom	202	2.4	382	7.6
Norway	75	0.9	66	1.3
Netherlands Antilles	231	2.7	189	3.7
Trinidad and Tobago	190	2.2	96	1.9
The Bahamas	147	1.7	125	2.5
US Virgin Islands	431	5.1	282	5.6
Puerto Rico	92	1.1	40	0.8
Other Non-OPEC	473	5.6	636	12.6
Persian Gulf	2,070	24.5	439	8.7
Caribbean region	2,221	26.3	1,980	39.2
Oil consumption	18,513		15,184	

^a Including refined products and natural gas liquids.

^b Because of rounding, components may not add to the totals shown.

purchaser of Mexican oil, taking over half of Mexico's 1.6 million b/d of crude oil exports in 1983. To limit its dependence on the US market, Mexico's policy objective since 1980 has been to sell no more than 50 percent of its crude exports to any country or furnish more than 20 percent of any country's oil imports.²

² The US share of Mexico's crude oil exports in 1983 would be slightly less than 50 percent if the \$1 billion worth of crude sold to the US strategic petroleum reserve—a sale critically needed by Mexico to raise cash—were excluded.

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Table 2
Caribbean Region:
Oil Production and Exports, 1983

*Thousand barrels
per day*

	Mexico ^a	Venezuela ^a	Trinidad and Tobago ^b
Production	2,666	1,781	159
Exports	1,606	1,475	110
United States	823 ^c	416	96
Canada	40	58	
Japan	120	21	
Europe	363	325	
United Kingdom	85	26	
West Germany	0	43	
France	83	20	
Italy	13	95	
Spain	162	21	
Others	20	119	
Caribbean/Central America	117	546	14
Netherlands Antilles	40	358	
Cuba	0	20	
Other	77	168	14
South America	61	76	
Brazil	56	55	
Other	5	21	
Israel	54	0	
Africa	0	22	
Asia	17	1	
Other	11	10	

^a Official government export statistics.

^b Estimated.

^c Includes 60,000 b/d of refined products.

Among Mexico's oil customers, only the United States is at or near the 50-percent ceiling. Spain, its second-largest customer, received only 10 percent of Mexico's crude exports in 1983.

Unless a significant turnaround occurs in world oil demand, Mexico will continue to depend on the US market. Still, continued US access to large quantities

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Table 3
Economic Importance of Oil Earnings
to Caribbean Producers, 1983 ^a

Percent

	GDP	Government Revenues	Export Earnings
Mexico	10	36	72
Venezuela	33	67	95
Trinidad and Tobago	36	59	91

^a Petroleum sector as a share of GDP, oil revenues as a share of government revenues, and oil exports as a share of total export earnings.

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of Mexican oil is not guaranteed. The US-Mexican oil relationship has been strained almost since production began in the early 1900s, and Mexico's heavy dependence on the United States continues to irritate most Mexicans. We believe any decision by Mexico City to curtail oil exports to the United States would be taken only under extreme circumstances because it would hurt not only oil revenues, but other key links as well:

- About 80 percent of Mexico's nonoil exports go to the United States, and Mexico depends heavily on US imports, particularly capital goods and food.
- About 25 percent of Mexico's \$98 billion foreign debt is owed to US banks.
- Two-thirds of foreign direct investment in Mexico comes from the United States.
- Salary remittances from Mexican immigrants in the United States, either legal or illegal, help to bolster Mexico's living standards and are a critical source of foreign exchange.

Apart from a political decision, access to Mexican oil also could be threatened by Mexico's strong oil workers' union, which could seriously disrupt oil supplies in a prolonged strike. Other problems include lingering peasant claims to compensation for land damaged during oil exploration and development in the 1970s. Peasants demanding reparations blockaded a refinery and nearly 200 wells in the southern state of Tabasco last year. Should economic distress lead to antigovernment violence or terrorism, oil installations would present attractive targets for sabotage or attack.³

³ Appendix A describes the general vulnerabilities of the major components that typically comprise petroleum production and export facilities.

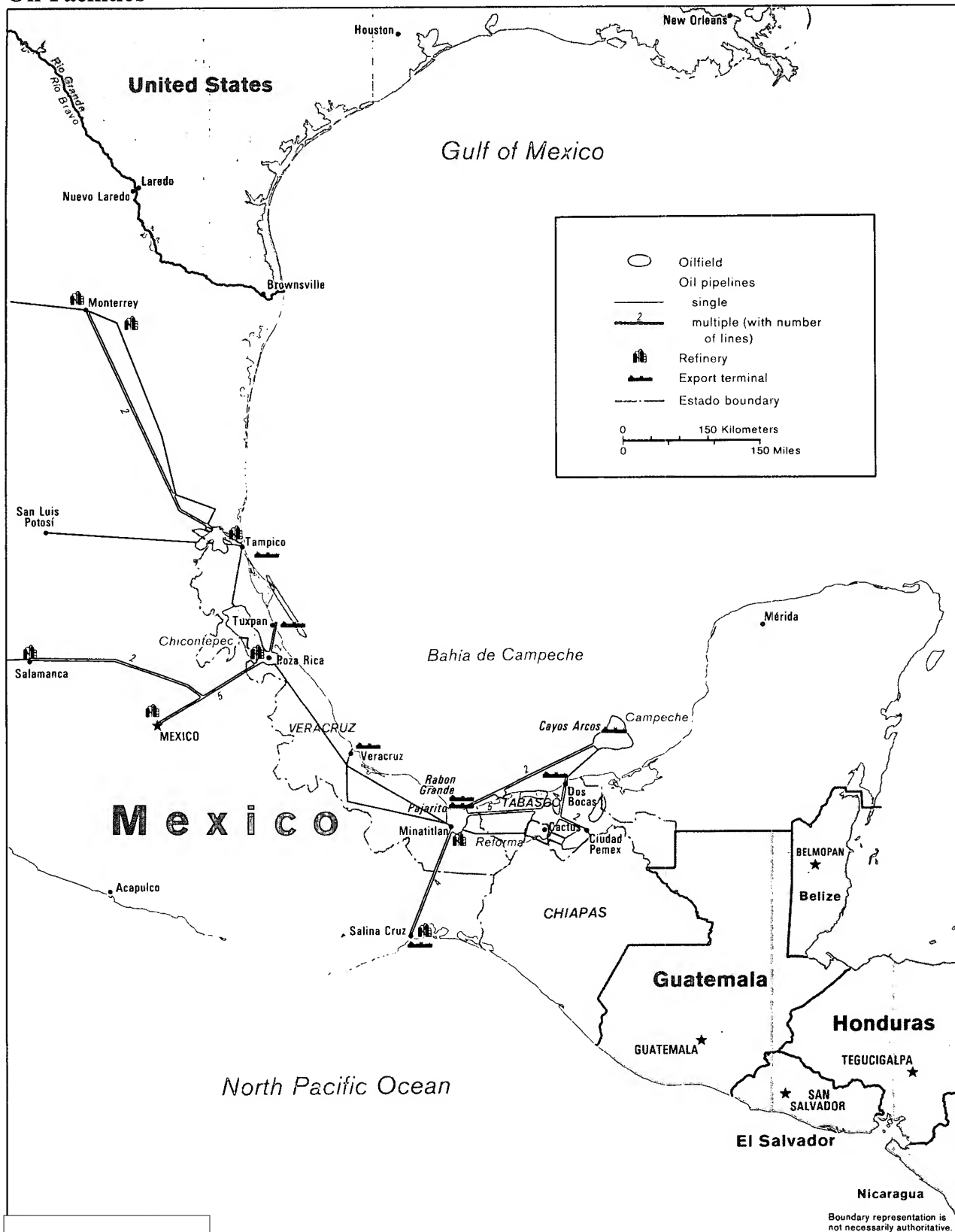
Vulnerable Oil Facilities. The chief vulnerability of petroleum facilities in Mexico is their physical concentration, with over 60 percent of the oil produced offshore in the Gulf of Campeche and almost all of the remainder coming from adjacent fields in the provinces of Vera Cruz, Tabasco, and Chiapas. The resurgence in Mexico's oil production since the mid-1970s and its geographic concentration has encouraged Pemex—Mexico's national oil company—to use modern technology in developing new oil and gas fields. The facilities are highly integrated, and the equipment is designed to take advantage of the economics of large-scale operations. Because the system has minimum redundancy in many areas, however, it is vulnerable.

Last year Mexico produced 2.7 million b/d of crude oil from approximately 3,600 wells. The bulk of this output—almost 1.7 million b/d—came from only about 125 oil wells in the Gulf of Campeche. These wells are supported by 20 production platforms, but destruction or serious damage to only three key platforms could completely halt offshore oil production. In addition, much of the output is exported through the oil terminal at Cayos Arcos, built on platforms 150 km at sea, which is earmarked to become Mexico's major export facility. Mindful of the vulnerability of this facility, Pemex already has completed multiple large-diameter pipelines from the offshore fields to its two onshore oil export terminals, reducing somewhat the possibility of export disruptions at the port at Cayos Arcos.

Mexico's ability to defend oil facilities against sabotage or other attack is limited. Although military units are stationed in oil-producing regions, none are permanently assigned to oil facilities. According to a US military officer with experience in Mexico, security at major oil installations consists of little more than an armed guard at the gate. Although most facilities are fenced, none have sophisticated electronic monitoring devices or other technical security systems.

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Figure 1
Oil Facilities



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In recent years, Mexico City has examined ways to improve its ability to defend the most vital oil installations. The Air Force has purchased a few fighter aircraft to bolster air defenses. The Navy has contemplated updating coastal surveillance systems to protect the vulnerable oil facilities offshore. [REDACTED]

[REDACTED] Because of Mexico's pressing economic difficulties, however, we believe it will be some time before substantial investments are made in oilfield security. [REDACTED]

Venezuela: Close Relationship With the United States

Last year the United States imported about 600,000 b/d of Venezuelan crude oil—including indirect imports of an estimated 175,000 b/d of petroleum refined in the Netherlands Antilles—which accounted for approximately 12 percent of US oil imports. The US share of total Venezuelan oil exports was 40 percent, or approximately the same as the previous year, and we believe sales will remain at about current levels through the rest of this decade. Slack world demand for refined products will continue to tie Venezuelan residual fuel oil exports to the US market, and Venezuela's increasingly heavier grades of crude oil exports will require the more sophisticated processing available in many US refineries. Nonetheless, we believe Caracas will continue attempts to lessen its dependence on the United States for oil sales, as well as oilfield technology and services. [REDACTED]

We believe Venezuelan officials are unlikely to seriously contemplate withholding oil exports to the United States. Revenues generated by US oil purchases are vital to Venezuela, contributing about 30 percent of that country's export earnings and over 20 percent of government revenues. As with Mexico, in contemplating any reduction in oil sales to the United States, Caracas would have to consider not only the effect on oil revenues but also the potential impact in nonoil areas. For example, about one-half of Venezuela's imports—primarily capital goods—come from the United States. [REDACTED]

Although the US-Venezuelan oil relationship generally has been smooth in recent years, a number of issues that have caused friction in the past could cloud

prospects for closer cooperation. The thorniest continuing irritant stems from Venezuela's 1976 nationalization of the petroleum industry. Claiming that taxes were owed to the government, Caracas withheld some funds that the oil companies—mostly US based—expected as compensation. Despite the continuing inability to reach a settlement in the dispute, however, relations between Venezuela's national oil company and most major US oil companies remain cordial. [REDACTED]

Venezuela's position as a founding member of OPEC also has periodically aggravated its oil relations with the United States. Caracas has maintained a relatively moderate stance within OPEC, however—particularly on prices—and also did not support the 1973-74 Arab oil embargo, even temporarily increasing production to ease pressure on world oil supplies. Should the Strait of Hormuz be closed for an extended period, we believe—based on public statements by Venezuelan officials [REDACTED]

[REDACTED] Venezuela would ultimately be prepared to increase its oil production.

Other issues also could affect the stability of Venezuelan oil exports to the United States. For example, Venezuela could try to link a lowering of US interest rates or other concessions on its external debt to oil sales, particularly if deliveries of Middle East supplies become severely disrupted. Under the former Herrera administration, Venezuela sought to link oil sales to such benefits as technological assistance and increased access to foreign markets [REDACTED]

Internal instability in Venezuela at levels that would seriously threaten US oil supplies seems unlikely in the next few years, although Venezuela's failure to diversify its economy could begin to challenge internal

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stability over the longer term. We expect little recovery in Venezuela's economy until oil prices rise substantially—an unlikely development through at least the late 1980s. Most Venezuelans seem to accept the necessity for increased belt tightening to lay the basis for sustained economic recovery. Nonetheless, soaring unemployment and prolonged austerity could provoke sporadic social unrest or conceivably—but less likely because of the military's vigilance—the beginnings of an insurgency. While we doubt that Venezuela's oil industry would be targeted directly because Venezuelans consider it part of their national heritage, political uncertainties in the country could indirectly threaten the reliability of Venezuelan oil supplies.

Redundant Oil Facilities. Redundancy in the Venezuelan oil system makes it much less vulnerable than Mexico's. The Venezuelan oil industry was built under the direction of 14 different oil concessionaires—comprised of over 20 oil companies, most US owned—each with separate crude processing systems, from pipelines to export terminals and refineries. Since nationalization, these operations have been consolidated into four producing companies under the umbrella of the national oil company, although much excess handling capacity still exists within the country's oil facilities. Constructed before 1970, most were built to handle oil production volumes double the current 1.8-million-b/d level.

Venezuela has almost 12,000 active oil wells in about 70 oilfields. All production comes from onshore fields—including those in Lake Maracaibo—and there are no plans to produce oil from the offshore continental shelf. Three-fourths of Venezuelan oil production comes from the western fields of the Maracaibo basin, which is served by seven export terminals with over 3.5 million b/d of total loading capacity. In eastern Venezuela, eight major long-distance crude oil pipelines connect the interior fields with five export facilities. These ports have a total capacity of over 1 million b/d of crude oil and refined products.

The most vulnerable facility in Venezuela is the 630,000-b/d refinery at Amuay, which contains over half the country's oil refining capacity. While its loss would deprive the economy of some supplies of lighter

refined products, particularly gasoline, the country's seven other refineries—including two large export plants—could meet most of the country's internal oil needs, with some margin for export. Venezuela, however, would lose some flexibility in marketing its oil. OPEC pricing guidelines do not apply to refined products, which allows Caracas the latitude to lower prices and boost product sales when demand for crude oil weakens.

Because Venezuela has not been seriously threatened by either internal or external threats, physical security at oil installations has had low priority.

In 1982 the Venezuelan Army surveyed oilfields to determine security requirements but no improvements have been observed, apparently because of financial constraints and the lack of a perceived threat.

The Caribbean Islands' Export Refineries

The primary significance of the Caribbean islands to US energy security is their oil refining and transshipment activities.⁴ The importance of Caribbean refineries has diminished considerably since the late 1970s, when US consumption exceeded domestic refining capacity and refineries in the Caribbean supplied the balance. Because of reduced oil demand since then, US domestic refineries now have about 2 million b/d in excess capacity—more than enough to handle the total amount refined in the islands. Nevertheless, loss of supplies from a Caribbean refinery could be significant if coupled with a disruption of oil flows into the Gulf of Mexico.

As US refiners pare excess capacity, demand for refined products from the Caribbean may revive. Meanwhile, continued underutilization of the island

⁴ Appendix C provides details on export refineries, export terminals, and transshipment facilities in the Caribbean.

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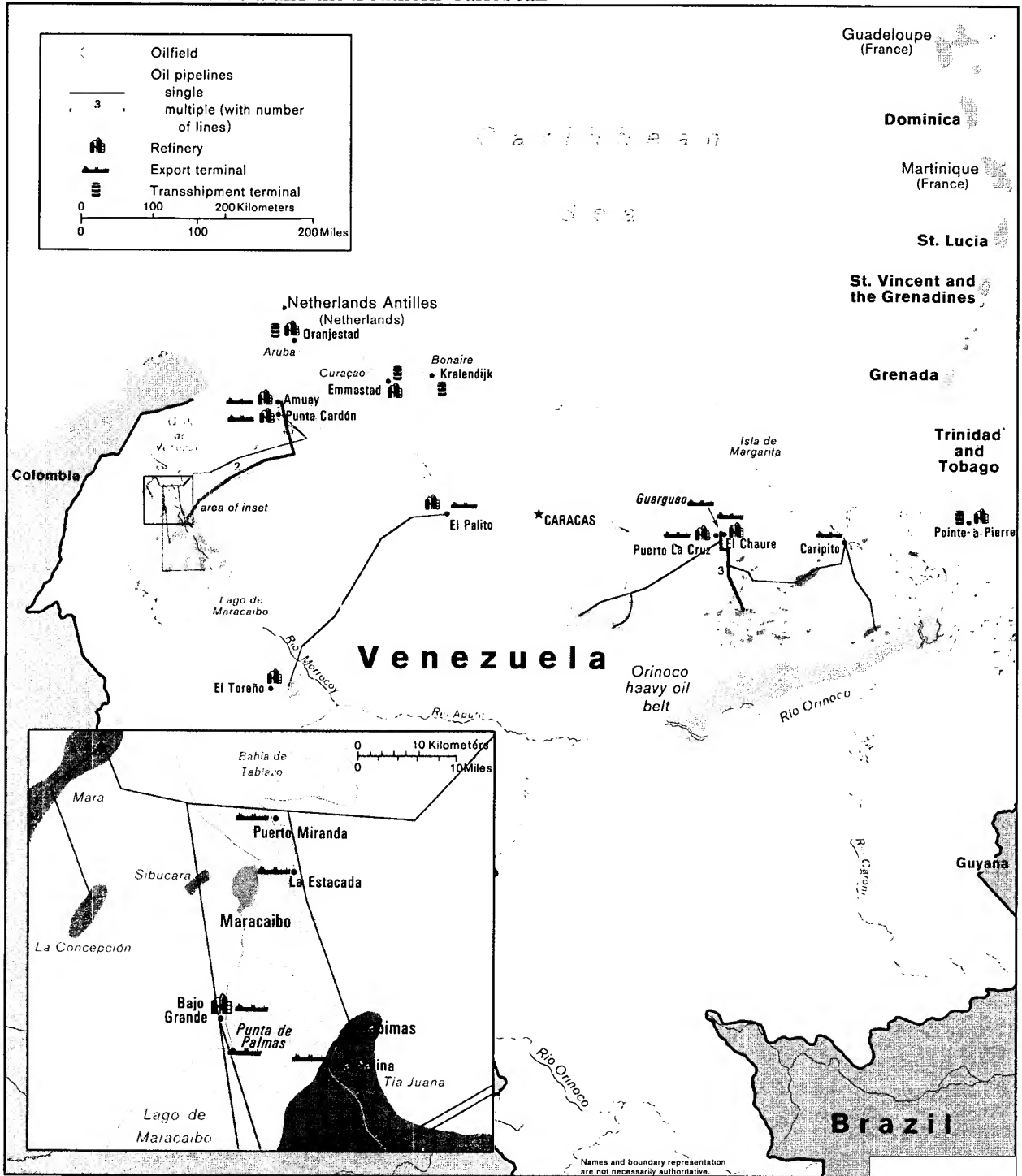
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Figure 2
Oil Facilities in Venezuela and the Southern Caribbean



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refineries—which ran at only about 45 percent of capacity in 1983—has encouraged gradual disinvestment that will inevitably reduce the region's refining capacity. []

Because of their size and almost nonexistent security arrangements, many of the islands' oil facilities would be vulnerable to hostility. Domestic unrest, strike, sabotage, or even direct military action or coup could interrupt operations and cause temporary dislocations for some US customers. Because of the large excess refining capacity available not only in the United States, but also throughout the Caribbean, however, other island refiners probably could make up the shortfalls. []

We doubt that US imports from the Caribbean island refineries would be jeopardized by actions taken by current governments there over the near term at least. The United States is the primary trading partner of and a major direct investor in these islands. Even if local governments expropriated foreign operations, the United States—because of its proximity and size—probably would remain the primary market for their product exports. []

Transport Routes

Approximately 8 million b/d of crude oil and refined products—representing one-third of the world's oil trade—move through the Gulf of Mexico and the Caribbean. Of this, 5 million b/d is destined for US gulf or Atlantic ports. Key petroleum cargoes that move in US trade through the Caribbean include crude oil from Alaska (via Panama), Mexico, Venezuela, Africa, the Middle East, Europe, and Asia, as well as products from Caribbean and US gulf coast refineries. The shipping lanes in the Caribbean most vital to the United States are the Straits of Florida and the Yucatan Channel, which handle about 50 percent of the region's oil traffic and provide the only access to and from US ports on the Gulf of Mexico. []

The Cuban Threat

Shipping using the Straits of Florida or Yucatan Channel would be potentially vulnerable to military attacks from Cuba. Other Caribbean sea lanes would

Table 4
Caribbean Region:
Primary Oil Flows

Million barrels per day

Origin	8.2
Caribbean region (including US gulf coast)	5.1
Atlantic (Europe, Africa, and Middle East)	1.9
Pacific (Alaska, Asia, and South America)	1.2
Destination	8.2
North America	5.1
Caribbean region	1.8
Europe, Africa, and Middle East	1.0
Asia and Pacific	0.3

present fewer and less accessible targets. Sea routes connecting the Caribbean Sea with the Atlantic Ocean, which handle about 30 percent of the oil traffic, would be almost impossible to interdict because of the many alternate routes. Because ships exiting the Panama Canal or transiting the open waters of the western Caribbean or Gulf of Mexico would be far from Cuba and relatively dispersed, they also would be considerably less tempting to Havana than vessels nearby. []

There are a number of circumstances under which Cuba might attempt to interfere with normal shipping in the Caribbean region. In a NATO-Warsaw Pact conflict, for example, Moscow probably would attempt to persuade Cuba to interdict US sea lanes in the west Atlantic and Caribbean.⁵ Whether the Soviets could accomplish this, however, is far from certain. Havana could also get involved under less extreme circumstances. For example, Castro might

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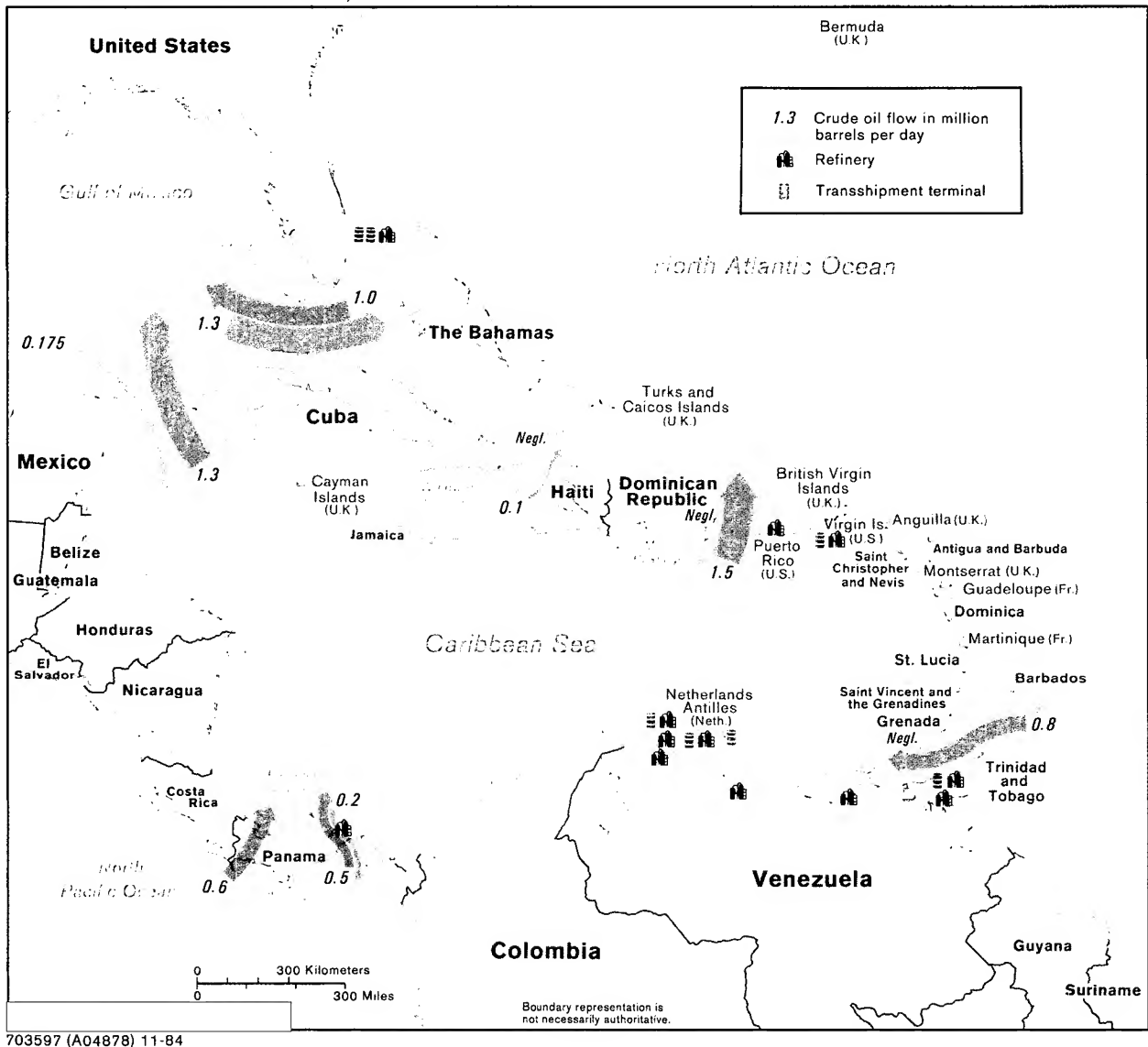
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Figure 3
Crude Oil Flow and Refineries, 1983



attempt to interfere with tankers or other shipping in the event of a US-sponsored invasion of Nicaragua, or attacks on Cuba itself by the United States or forces friendly to the United States. If the Cuban military were to become directly involved, we believe their emphasis would be on striking isolated or lightly defended ships rather than on a more ambitious sea lane interdiction campaign. [REDACTED]

The Cubans could also covertly interfere with shipping operations in the Caribbean region. For example, Cuba could use its submarines to transport small detachments of personnel to infiltrate and sabotage ports and shipping terminals. [REDACTED]

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The Threat From Cuba

Cuba, because of its location and large armed forces, poses a potential threat to shipping in nearby sea lanes. Although oriented primarily for defense, Cuba's Navy and Air Force could significantly damage oil tankers and other undefended shipping in nearby sea lanes. The success of such attacks would depend primarily on what US forces were available to protect shipping or to retaliate against Cuba, and on whether the United States had taken steps to neutralize Cuba's combat capabilities—by preemptive air attacks, for example. []

In peacetime, the Soviets do not routinely maintain forces in Cuba that would pose a threat to shipping. Soviet naval task forces make a visit to Cuba about once a year. These forces would either not be deployed to Cuba or would be withdrawn—if already deployed—if major hostilities appear likely. We believe the Soviets, recognizing they probably could not reinforce Cuba during major hostilities, probably would instead pressure Havana to use its Soviet-supplied weapon systems to harass US shipping. []

Regardless of whether Havana was conducting Soviet-prompted antishipping operations during a war or responding to a provocation, its three diesel-attack submarines would pose the greatest potential threat to shipping lanes, as well as to more distant ports and shipping terminals. Because it is much easier to attack lone merchant ships than to defend them, the presence of just one submarine could prove disruptive. Each submarine can carry 22 torpedoes, as well as lay mines, and can operate away from base for extended periods. []

In addition to its submarines, the Navy's surface combatants—such as its two Koni-class frigates, which have a modest antiship capability, also could

interdict shipping. Because they would be highly vulnerable to attack from US forces, however, Havana probably would prefer to reserve them for defense. []

As for air capabilities, Cuban transports, jet fighters, and combat helicopters—including MI-14 antisubmarine warfare helicopters acquired late last year—could perform reconnaissance of key passages, passing target information to Cuban submarines or other vessels. All of Cuba's approximately 150 MIG fighters, either independently or with Cuban naval combatants, also could strike undefended ships in the Straits of Florida and Yucatan Channel. Cuba's MIGs can be armed with rockets, bombs, and air-to-surface missiles with a range of 11 kilometers. In the face of a significant US military response, however—particularly if it included strikes against Cuba's few main fighter bases—Cuba's capability to launch further attacks would be diminished considerably. []

Aside from the constraints imposed by Cuba's vulnerability to US military forces in the region, a number of other factors would limit the effectiveness of Cuban antishipping operations. The number of Cuban forces that we believe Havana would be willing to allocate to such operations is relatively small. Because of maintenance and resupply requirements, for example, no more than two submarines probably would be in service on any given day, and any in port would be highly vulnerable. Accurate and timely intelligence on ship identification and location also could be difficult. Nonetheless, the threat of even limited Cuban military action could disrupt normal shipping by necessitating military protection for some shipments or causing others to be rerouted away from the region entirely. []

ships, many of which also can lay mines. Finally, Havana could attempt to pressure pro-Cuban leftist groups throughout the region into sabotage of shipping terminals or other key facilities. []

Mining of harbors could also be accomplished covertly, using either Cuba's submarines or its merchant

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The Panama Canal and Oil Pipeline

In 1983, approximately 700,000 b/d of Alaskan North Slope crude oil transited Panama for refining in the Caribbean and the gulf coast of the United States. About 600,000 b/d went via the trans-Panama crude oil pipeline, which became operational in late 1982, with the remainder transiting the Panama Canal in tankers. The United States and Panama will continue to operate the Canal jointly until Panama assumes total responsibility in the year 2000. US companies currently own 60-percent interest in the 800,000-b/d-capacity pipeline, with Panama having the right to acquire majority ownership after 1988. If the pipeline were damaged or closed, oil could still be delivered via the Canal. Without use of both the pipeline and the Canal, oil would have to be shipped around South America, adding at least one month to the transit time. []

Considering the extensive military and political ties between the United States and Panama—and the vital importance of US aid and Canal revenues to the Panamanian economy—we strongly doubt that Panama's current government would initiate or support any action designed to deny the United States access to either the Canal or oil pipeline. The Canal has been the major source of tension between Panama and the United States for decades, although bilateral relations have improved considerably since the Canal treaties went into effect in 1979. The prospect of a leftist or anti-US government, however, could jeopardize US access to the Canal and pipeline. []

Unlike many of its neighbors, Panama is not threatened by an internal insurgency. Organized labor is still a weak political force, but strikes by Canal area workers could delay shipping. By the end of the 1980s, worsening economic conditions and the regional insurgent threat could begin to challenge the country's internal stability. Moreover, anti-US sentiment among the population could persist into the 1990s, with the Canal in particular representing an attractive target for striking out at Washington. []

Potential physical threats to the pipeline and Canal range from violence by anti-US leftist student groups—often accused by the government of instigating mob violence in Panama City—to conventional assaults by Cuban or other military forces staging

**Panama's Canal and Oil Pipeline:
Physical Vulnerabilities**

The Panama Canal and oil pipeline are highly vulnerable:

- *With its complex set of locks, dams, and power systems, the Canal is vulnerable to a wide variety of military actions that could disrupt or close it for extended periods. Its locks, for example, could be rendered unusable by an explosion in the hydraulic system or a scuttled ship. A major strike against the Gatun Dam, which could significantly lower the level of the lake that feeds the lock system, could close the Canal months if not years.*
- *The pipeline probably is most vulnerable along short stretches of exposed sections north of the Caldera pump station, although sabotaging the line itself probably would disrupt operations for only one to two weeks at most. The most tempting targets in terms of longer term damage are the system's two pumping stations—near Puerto Armuelles on the Pacific coast and at Caldera, some 82 kilometers inland—and the mooring buoys at Chiriqui Grande, the pipeline's Caribbean terminus. We estimate that extensive damage to any of these facilities could disable the pipeline or significantly reduce its flow for six months to one year.* []

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from Nicaragua. International terrorists could attempt to sabotage either facility, although neither has been threatened in the past. Small groups of Cuban or Nicaraguan saboteurs, infiltrated by ground from Nicaragua, also could attack. Mining operations similar to recent events in the Red Sea and Suez Canal area could also occur without warning. []

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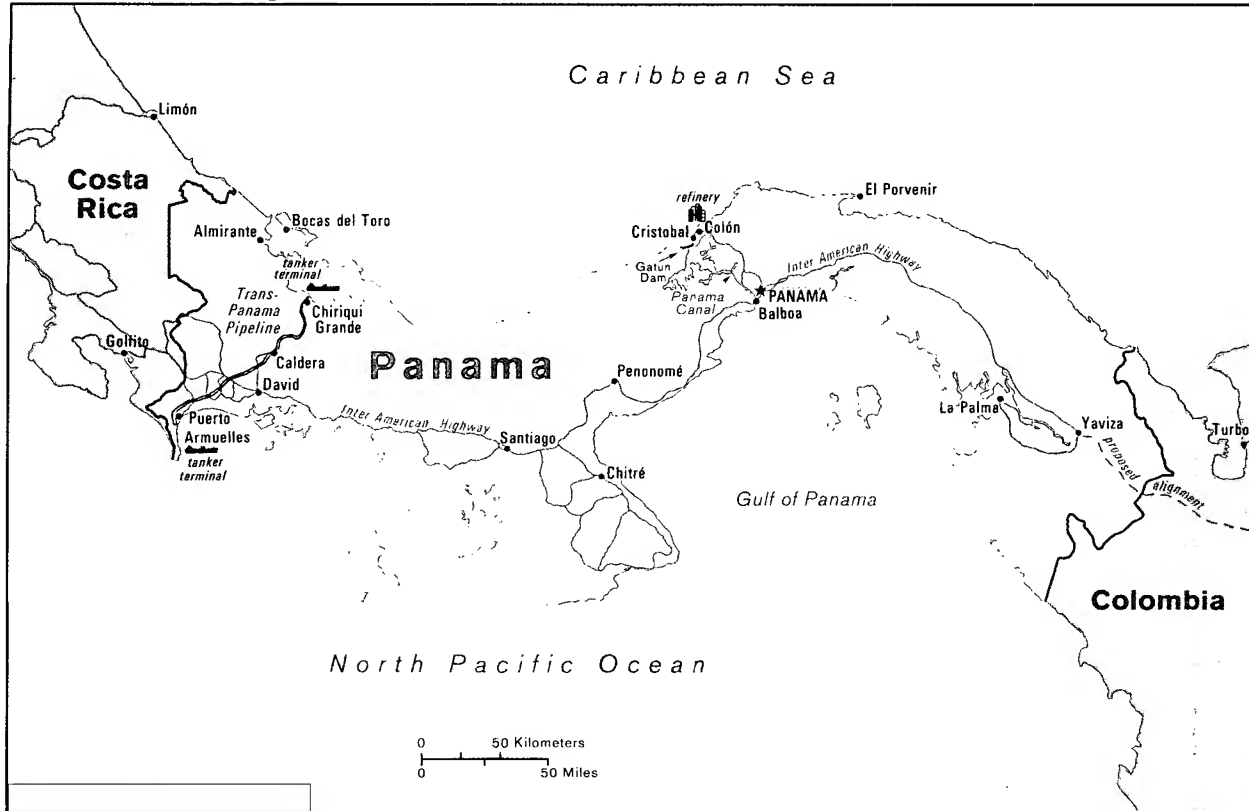
In our view, the antiterrorist capability of the Panamanian Defense Forces, although improving, is inadequate to protect either the Canal or the pipeline. Moreover, the presence of several thousand US military personnel, while acting as a deterrent, does not

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Figure 4
Trans-Panama Oil Pipeline



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eliminate the Canal's inherent physical vulnerability. And the pipeline, except for its pumping stations, is essentially unguarded. Depending on the severity of any damage, operations at these facilities could be disrupted for as little as a few days to more than several months.

Implications for the United States

The present surplus productive capacity available in the non-Communist world—estimated at over 8 million b/d, 7 million b/d of which is outside the Western Hemisphere—lessens US or Western dependence on any one Caribbean source. The worst case scenario for a disruption—the combined loss of Mexican and Venezuelan oil production—would remove 4 to 4.5 million b/d of crude oil from world

supplies. Excluding domestic consumption in these two countries, this would mean a reduction of about 3 million b/d—or some 12 percent—in the non-Communist world's oil export trade:

- Although such a loss would put upward pressure on oil prices, we believe lost supplies could be replaced from the Middle East.
- Persian Gulf producers, excluding Iran and Iraq, have over 4 million b/d in available excess capacity; moreover, Saudi Arabia's policy is to use its productive ability to stabilize world oil prices.
- Some localized shortages and temporary increases in oil prices would occur, however, until affected US and European refiners secure alternate supplies.

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Table 5 *Thousand barrels per day*
US Refinery Capacity ^a

Area	Operating Capacity	Refinery Input	Excess Capacity	Percent Utilization
Total	14,838	12,650	2,188	85.3
East coast/ Appalachia	1,409	1,184	225	84.0
Midwest	3,281	2,955	326	90.1
Gulf coast/ Southwest	6,760	5,930	830	87.7
Rocky Mountains	529	421	108	79.6
West coast/ Pacific	2,859	2,160	699	75.6

^a As of 1 January 1984.

Drawdowns from the Strategic Petroleum Reserve could provide over 1 million b/d to gulf coast refiners for several months and refined product imports of about 300,000 b/d could be diverted to the east coast. The supplies necessary to fill the remaining crude oil shortage on the US gulf coast would then have to come from Mexico. Assuming Mexican production and export facilities remained secure, most of the available Mexican export stream could be rerouted to the United States through Texas or Louisiana. While the matchup of crude types to refinery capabilities may be less than optimum, it could make the difference in an emergency. It would also provide the Mexicans with a continuous flow of oil revenue because they would be unable to make deliveries to Latin American and European customers.

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At least for the next few years, alternate crude oil supplies will be readily available for the United States in the event of an oil supply disruption in the Caribbean. The free flow of oil into the Gulf of Mexico remains vital to US energy security, nonetheless:

- Two-thirds of US refining capacity is in Texas, Louisiana, and the American midwest.
- The 2.5 million b/d of imported and Alaskan crude oil delivered through the Gulf of Mexico accounts for approximately one-fifth of the input to US refineries and 20 percent of total US oil consumption.

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Should shipping through the Gulf of Mexico be disrupted, diversion of these supplies to the US east or west coasts would be impractical:

- Department of Energy statistics show less than 1 million b/d of excess refinery capacity in the coastal areas, only 200,000 b/d of which is located in the east.
- Moreover, no pipelines exist, or are planned, that could carry crude oil from either the east or west coast to the interior of the United States for processing.

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Appendix B

Caribbean Region: Oil Potential

We estimate from open sources and US Government analysis that, as of January 1984, proved oil reserves in Mexico and Venezuela amounted to about 50 billion barrels—about 7 percent of the world's total. Minor producers along the Caribbean littoral contribute another 1.3 billion barrels in proved reserves. The area also holds a minimum of 25 billion barrels of probable reserves, oil which in all likelihood will be produced given favorable economic circumstances. In addition, deposits in Venezuela's Orinoco heavy oil belt could eventually yield billions of barrels even if only a small fraction of the reserve—estimated at a minimum of 1 trillion barrels—can be recovered.

Although the Venezuelan Ministry of Energy and Mines publicly estimated the country's proved oil reserves to be almost 26 billion barrels, including some 4 billion barrels in the Orinoco region, we believe this is somewhat optimistic. Using open sources on oilfield production, we estimate that Venezuela has 21 billion barrels of proved reserves. Current and probable future oil prices indicate that Venezuela's oil revenues should be sufficient to provide the investment needed to exploit these reserves.

Mexican reserve estimates follow a similar, but more pronounced, pattern. Pemex claimed to have nearly 50 billion barrels of proved reserves as of March 1984. An extensive technical analysis of Mexican oilfield data by the US Department of Energy, however, indicates that remaining recoverable reserves are substantially below that figure, possibly about 30 billion barrels. Mexico must invest heavily in more aggressive exploration to maintain its current production of 2.7 million b/d throughout the decade.

In addition to Venezuela and Mexico, the Caribbean region has another 1.3 billion barrels in proved oil reserves held by smaller producers. *Trinidad and Tobago*, however, faces a steep decline in oil production in the 1990s if additional oil reserves are not

Table B-1
Caribbean Region:
Oil Production and Reserves

Country	1983 Production (1,000 barrels per day)	Proved Reserves (million barrels)
Mexico	2,666	30,000
Venezuela	1,781	21,000
Trinidad and Tobago	159	580
Colombia	152	635
Guatemala	8	50
Cuba	8	NA
Barbados	1	1

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discovered soon. *Colombia's* exploration and development program, revitalized after a change in foreign investment laws in 1976, paid off last year when oil production rose for the first time since 1970. According to Embassy reporting, proved reserves increased to 635 million barrels in 1983, and discoveries in border areas next to Venezuela and Ecuador hold promise for increases. If realized, they could make Colombia a small net exporter of oil, particularly if Bogota can curb rapidly rising domestic oil consumption.

Recent discoveries in northern *Guatemala* have raised hope that the rich oil deposits of southern Mexico extend into the country. But one large operator—the French firm ELF—recently announced its withdrawal from Guatemala, claiming the “geological situation was no longer of interest” and that revised oil investment laws make their venture less profitable. Our preliminary analysis of the area's geology also tends to support this position. And, unless the government answers foreign investment concerns adequately, the ELF pullout could seriously hinder Guatemala's efforts to develop the country's oil reserves.

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Appendix C

Caribbean Region: Oil Refining and Transshipment

Before 1950, much of the oil trade in the Caribbean region consisted of petroleum products from export refineries in Venezuela and the Netherlands Antilles. This was carried in oil tankers 15,000 to 20,000 dwt in size, ships able to enter the shallow ports of the US gulf and east coasts. The closure of the Suez Canal in 1956 caused a revolution in the transportation of oil at sea, bringing about the construction of giant tankers which could economically haul the ever increasing volumes of Middle Eastern oil around the Cape of Good Hope to Western markets.

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The inability of US ports to handle ships of this size, however, led to the construction of additional large offshore export refineries and transshipment terminals in the Caribbean. Here tankers could be off-loaded, their cargoes transferred to smaller ships or refined, and then sent to the United States. The oil price increases of the 1970s, however, have severely affected these activities. Imports of refined products from the Caribbean—predominantly residual fuel oil—fell from a peak of 2.1 million b/d in 1973 to about 1 million b/d last year. And the transshipment of Middle Eastern and African crudes within the region dropped from an estimated peak of 4.4 million b/d in 1979 to about 1 million b/d in 1983

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Table C-1
Caribbean Region:
Major Oil Facilities

Facility	Facility Capacity (1,000 barrels per day)	Estimated 1983 Throughput (1,000 barrels per day)	Storage Capacity (million barrels)	Tanker Size (1,000 dead-weight tons)	Remarks
Export refineries					
Venezuela					
Amuay	630	370	48.5	110	Recent upgrading makes Amuay and Punta Cardon Venezuela's most modern refineries.
Punta Cardon	325	230	21.8	130	
Puerto La Cruz	156	110	9.5	110	
The Bahamas					
Freeport	500	100	13.5	500	Might be closed by 1986.
Netherlands Antilles					
Aruba	420	240	14.0	500	Primarily Venezuelan crude. Recent press reports indicate that this will be closed in 1985.
Curacao	320	190	16.0	530	Primarily Venezuelan crude.
Puerto Rico					
Yabucoa	85	75	NA	100	Mostly local consumption.
Trinidad and Tobago					
Pointe-a-Pierre	275	65	NA	260	Crude input from local production.
US Virgin Islands					
St. Croix	600	330	NA	170	
Oil export terminals					
Mexico					
Cayos Arcos	1,000	NA	3.5	272	150 km offshore; loading is from a storage tanker and two single-point mooring buoys.
Dos Bocas	500	NA	3.0	272	Two single-point mooring buoys.
Pajarito	1,800	NA	3.8	80	Mexico's largest oil terminal; four piers, eight berths.
Rabon Grande	500	NA		272	Offshore Pajarito; two single-point mooring buoys.
Salina Cruz	500	125	3.1	272	Located on the Pacific Ocean; two single-point mooring buoys.
Venezuela					
Amuay	700	445	48.5	110	Primarily refined product exports.
Bajo Grande	150	60	12.1	70	Primarily crude oil exports.
Punta Cardon	500	200	21.8	130	Primarily refined product exports.
Caripito	100	50	3.2	50	Exports only refined products.
El Chaure	50	15	2.4	55	Exports only refined products.
El Palito	90	10	5.5	55	Exports only refined products.

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Table C-1 (continued)

Facility	Facility Capacity (1,000 barrels per day)	Estimated 1983 Throughput (1,000 barrels per day)	Storage Capacity (million barrels)	Tanker Size (1,000 dead-weight tons)	Remarks	
Guarguao	700	75	9.5	110	Next to Puerto La Cruz, exports primarily crude oil.	
La Estacada	90	5	1.4	100	Primarily refined products.	
La Salina	1,000	325	4.7	110	Crude oil only.	
Puerto La Cruz	150	65	9.5	110	Refined products only.	
Puerto Miranda	1,000	375	6.2	115	Crude oil only.	
Punta de Palmas	200	50	3.1	100	Crude oil only.	
Crude oil transshipment terminals						
The Bahamas						
Freeport	225	215	6.5	500	Colocated with export refinery.	
South Riding Point	410	115	5.3	450	Effective throughput capacity estimated to be only about 300,000 b/d.	
Netherlands Antilles						
Aruba	440	25	6.6	550	Colocated with export refinery; effective throughput capacity estimated to be 300,000 b/d.	
Bonaire	450	75	10.0	500		
Curacao	1,025	120	16.0	530	Colocated with export refinery.	
Trinidad and Tobago						
Pointe-a-Pierre	100	90	1.5	270	Colocated with export refinery.	
US Virgin Islands						
St. Croix	115	115	NA	170	Colocated with export refinery.	
Crude oil pipelines						
	Pipeline Capacity (1,000 b/d)	Estimated 1983 Throughput (1,000 b/d)	Diameter (inches)	Length (km)	Loading Terminal	
					Storage capacity (million bbl)	Tanker Size (1,000 dwt)
Panama						
Trans-Panama Pipeline	800	600	36-40	131	Chiriqui Grande: 2.5 Puerto Armuelles: 2.5	160 265
						Runs from Puerto Armuelles (Pacific) to Chiriqui Grande (Caribbean); carries only Alaskan North Slope crude oil.
Mexico						
Salina Cruz Pipe-line	400	300	30	280	3.1	272
						Originates in the vicinity of Pajarito; also supplies crude oil to a 170,000-b/d capacity refinery at Salina Cruz.

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Appendix D

Caribbean Region: Oil Flows and Tanker Movements

The Straits of Florida and the Yucatan Channel—gateways to the Gulf of Mexico—handle 47 percent of the oil flows in the Caribbean region. Twenty percent of the oil transits the Windward and the Mona Passages, which are used interchangeably by ships going to the US Atlantic coast, or to Europe from Panama, Venezuela, or the Netherlands Antilles. The passage between Trinidad and Tobago handles 10 percent of the flows and is transited by vessels arriving from or departing to the Middle East and West Africa.

Based on an average size of 30,000 to 35,000 dwt for product tankers and 60,000 to 120,000 dwt for crude carriers, it is estimated that on average a minimum of 16 daily tanker transits through the five major passages were needed to sustain the oil flows recorded in the Caribbean region in 1983. The actual number of tanker transits, however, is probably more than twice this level for the following reasons:

- Tankers involved in oil trade with nations outside the region must both enter and leave this area through these passages.
- Some tankers carry only partial cargoes.

Table D-1
Caribbean Region: Prominent Passages and Choke Points

Passage	Width (nautical miles)	Chart Depth (meters)
Straits of Florida	Over 90	Over 180
Deepwater Bahamas passages		
NE Providence Channel	35	From 180 to over 1,000
NW Providence Channel	39	From 180 to over 900
Santaren Channel	31	Over 300
Nicholas Channel	33	Over 300
Crooked Island Passage	29	From 900 to over 1,000
Calcos Passage	36	Over 1,000
Windward Passage	54	Over 1,000
Mona Passage	43	From 200 to over 1,000
Anegada Passage	45	Over 1,000
Dominica Channel	22	From 73 to over 1,000
Guadeloupe Passage	29	From 60 to over 1,000
St. Lucia Channel	18	From 36 to over 1,000
Passage between Tobago and Grenada	80	Depths exceed 180
Galleon's Passage	19	Depths exceed 180
Jamaica Channel	Over 100	Over 1,000
Yucatan Channel	100	Over 1,000
Panama Canal	32 meters	About 12 meters
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Table D-2

Thousand barrels per day

Caribbean Region: Oil Movements, 1983

To:	Mexico	Venezuela	Caribbean Basin	US East Coast	US Gulf Coast	US West Coast/ Alaska	Canada	Europe	Middle East	Africa	Pacific	Total
Total	24	2	1,787	2,068	2,900	25	98	883	57	32	245	8,121
From:												
Mexico		0	169	122	704	0	40	363	54	0	154	1,606
Venezuela	0		612	303	114	5	58	325	0	22	42	1,481
Caribbean Basin	0	0	162	529	196	8	0	0	0	0	49	944
US east coast	0	0	6		10	0	0	0	0	0	0	16
US gulf coast	24	2	55	745		12	0	193	3	10	0	1,044
US west coast/ Alaska	0	0	127	135	577		0	0	0	0	0	839
Canada	0	0	0	0	0	0		0	0	0	0	0
Europe	0	0	236	0	251	0	0		0	0	0	487
Middle East	0	0	164	40 ^a	360	0	0	0		0	0	564
Africa	0	0	143	80 ^a	561	0	0	0	0		0	784
Pacific	0	0	113	114	127	0	0	2	0	0		356

^a Oil volume estimated to have been transshipped at Caribbean locations en route to US east coast.

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Table D-3
Caribbean Region: Oil And Tanker Movements
Through Key Passages, 1983

Passage	Oil Flows (1,000 b/d)	Daily Fully Loaded Transits (average number)	Annual Fully Loaded Transits (average number)
Total	6,229	16.48	6,015.0
Straits of Florida	2,310	6.77	2,471.2
US gulf coast to US east coast	745	2.73	996.5
US gulf coast to Europe	193	0.49	178.9
Mexico to US east coast	97	0.33	120.5
Mexico to Europe	260	0.55	200.7
Middle East to US gulf coast	360	1.00	365.0
Europe to US gulf coast	251	0.54	197.1
USSR to Cuba	205	0.71	259.2
Africa to US gulf coast	128	0.16	58.4
The Bahamas to US gulf coast	71	0.26	94.9
Yucatan Channel	1,511	3.46	1,267.3
Panama to US gulf coast:			
from Alaska	494	1.37	500.1
from Asia	150	0.26	94.9
from South America	161	0.44	160.6
Africa to US gulf coast	350	0.40	146.0
Mexico to Netherlands Antilles	175	0.37	135.1
Venezuela to US gulf coast	114	0.40	146.0
Trinidad and Tobago to US gulf coast	57	0.19	69.4
Netherlands Antilles to US gulf coast	10	0.03	10.2
Windward and Mona Passages	1,609	5.32	1,942.0
Venezuela to Europe	395	1.09	387.9
Venezuela to US east coast	223	0.81	295.7
Netherlands Antilles to US east coast	485	1.71	624.2
Netherlands Antilles to Europe	135	0.38	138.7
US Virgin Islands to US east coast	246	0.90	328.5
Alaska (via Panama) to US east coast	125	0.43	157.0
Passage between Tobago and Grenada	799	0.93	339.6
Africa to US gulf coast	350	0.41	149.7
Africa to Netherlands Antilles	306	0.35	127.8
Middle East to Nether- lands Antilles	143	0.17	62.1

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